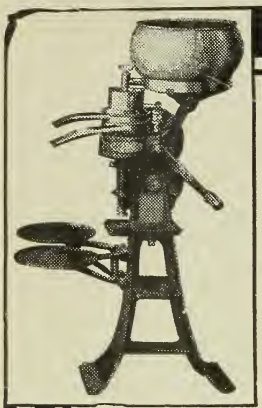

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THE AGRICULTURAL STUDENT

A MONTHLY MAGAZINE DEVOTED TO AGRICULTURAL EDUCATION

MAY, 1910

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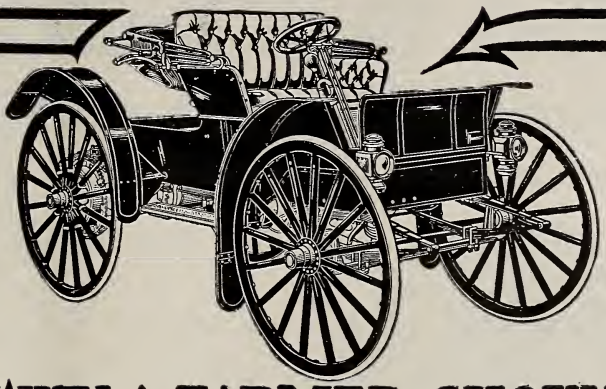

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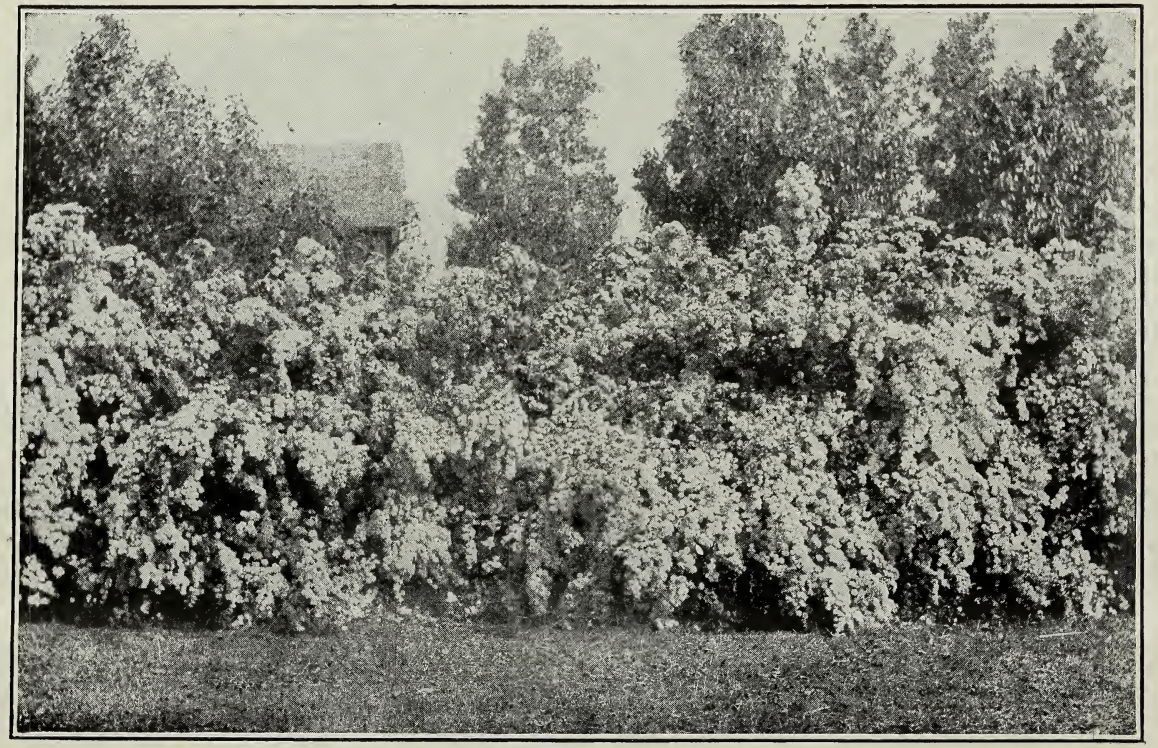
LOOK FOR THE TRADE MARK. IT IS A SEAL OF EXCELLENCE AND A GUARANTEE OF QUALITY.

LOOK FOR THIS TRADE MARK ON THE GENUINE

Contents May 1910

The Pfeifer Show Print Co., Columbus, O.



Spirea Van Houtte, an Excellent Shrub Flowering in May and June.

THE
AGRICULTURAL STUDENT

Vol. XVI. OHIO STATE UNIVERSITY, COLUMBUS, MAY, 1910 Number 8

Why Not Plant Orchards?

By Prof. Wendell Paddock

The writer has been interested in watching the Columbus markets during the past fall and early winter in order to become familiar with this, the most important phase of fruit production. One always wants to know where fruit comes from and he very soon notices that most of the barreled apples come from Michigan and New York, and a few from Ohio. Some bulk apples are also shipped in from these states, while a few also come from our own state; more bulk apples come from Ohio, however, than are marketed in barrels. The bulk apples are usually very inferior, being bruised and dirty, more or less scabby and wormy, many showing abundant evidence of San Jose Scale and usually several carieties are found in the same lot.

What is true of Columbus is no doubt true also of other large markets of the State, and the question at once arises, why are we not producing more and better fruit? The writer is aware that in a few localities the business of orcharding is well developed, but taking the State as a whole, vast improvement is possible.

In looking about for reasons why there is not greater interest taken in apple growing we find it difficult to discover all of the causes, but some of the common objections urged against the business are as follows: Too many insects and diseases; change of climate and a worn-out soil; no use to plant orchards, as it takes too long for the trees to come into bearing. As we see the situation, there are few of the eastern states which have better natural advantages for the production of fine fruit. When once the business side of fruit growing has been developed, the objections above mentioned will soon vanish. We have seen apples grown in various sections of Ohio that would command a premium on any market and a comparatively few men are securing returns which rival those that are obtained from the famous orchards of the West.

As concrete illustrations are more convincing than argument, the liberty has been taken to give the experience of a few of our fruit growers.

The Carson Brothers, of Marietta, O., leased an orchard for the season 1909. It originally comprised about thirty-five acres, but many of the trees were missing, the orchard had been generally neglected, and had been in an unfruitful condition for a number of years.. In fact, it was in the condition in which we find so many of the older orchards in many sections of the State.

The orchard was thoroughly sprayed for apple scab and codling moth worms and the total expense of the season, including the lease, spraying, harvesting of the fruit, and storage until May 1, 1910, was $2,000. A thousand barrels

of fruit are in storage at the present time, the market price of which is something over $4 a barrel. This will leave a net income of $2,000 for the labor of these two young men, one of them for six weeks and the other for four.

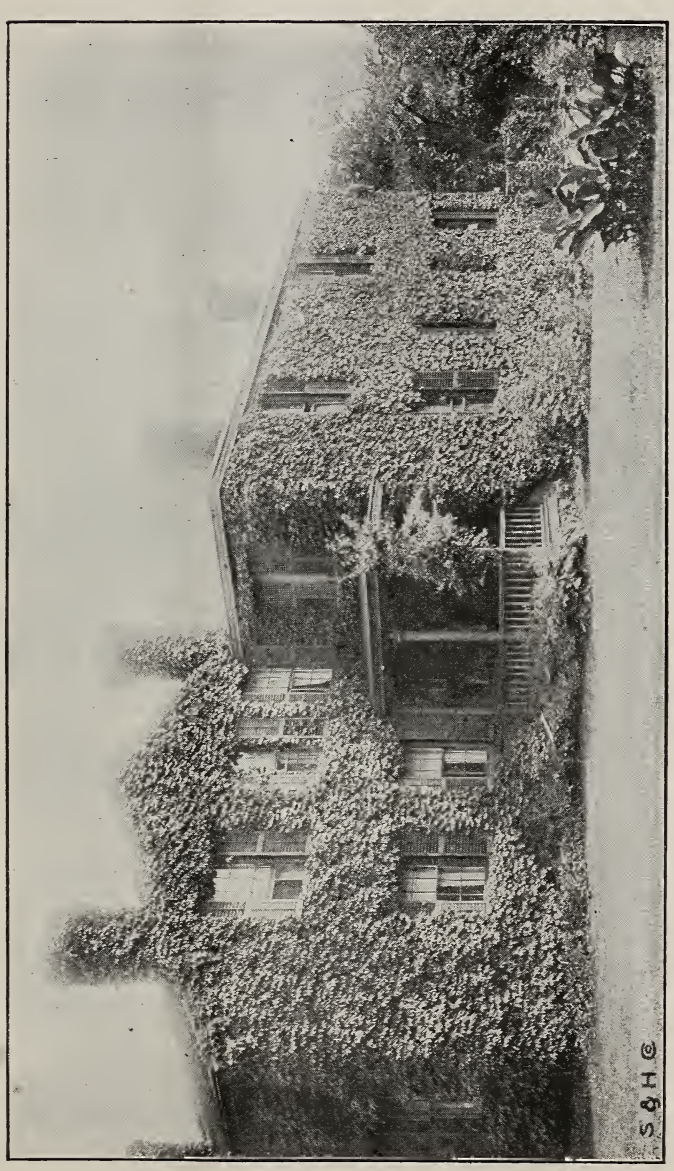
We believe that these results were exceptional only for the reason that these two young men displayed an unusual amount of intelligence and industry. There are a good many hundreds of acres of old orchards that are in the same condition, and there is little doubt but that similar returns may be secured from most of them, if the proper methods are used. The owners of such neglected orchards cannot afford to stop with the mere matter of spraying, but all must attempt to improve the quantity and the quality of the product by pruning, fertilizing, and, possibly, cultivation.

Here is the record of John A. Stoakes of Fremont, Ohio. He has twelve acres in his orchard, 4 acres of which are 22 years old, four acres 15 years old, and four acres 12 years old. During the season of 1908 there were picked from the entire orchard 1500 barrels of fruit which was sold for $7400. The total expenses of the season amounted to $1400, which, deducted from the total sales, left a net profit of $6,000 for the entire 12 acres of orchard, or a net income of $500 an acre.

During this season the horicultural department of the Experiment Station selected some trees in this orchard for a spraying demonstraton. In this lot there were 55 Ben Davis, 22 years old. This block of trees was sprayed thoroughly for apple scab and codling moth, and from 40 trees on one acre of this area, 288 barrels of fruit were secured, which sold for $1408. The total expenses for the season per acre for this demonstration was $360, which, deducted from the total sales, leaves a net profit of $1048 per acre.

Further comment upon these results is unnecessary. In answer to the idea that one cannot afford to plant trees because of the long time it takes them to come into bearing, one needs but to point to the experience of Mr. F. P. Vergon, Delaware, Ohio. Mr. Vergon planted his trees when he was sixty years old. He has lived to see them come to maturity and now at the age of 80 he has harvested 13 paying crops. There is nothing that he could have possibly devoted this land to that would have brought him anywhere near the returns that the apple trees have done, and in the meantime the value of the land has been increasing many fold. Things at a distance very often look better to us than those close at home, hence we are inclined to look with longing eyes at the orchards of the far West, but many of us are deterred from investing in that country for the reason that such high prices are asked for bearing orchards, but probably very few people stop to figure what good bearing orchards in our own State are worth. We all know that if an orchard is at all intelligently handled one should secure at least $150 net returns on an average per year. Most of us do not seem to realize that such returns are paying us interest at the rate of 6 per cent. on an investment of $2,500 per acre. Surely we have not appreciated the resources of our own State. We are certain that Ohio is destined to become famous as a fruit producing state, but why leave this work to be developed, the profits to be reaped by future generations, or by alien people? There is already an awakened interest in fruit growing and some orchards are being planted, but it is to be hoped that the

day is not far distant when all of the suitable orchard land in the state will be devoted to the purpose for which it is so well adapted.



Ampelopsis Veitchi

The hardy vines are a great boon to home-makers because the rapidity of their growth will in one season do much to overcome that appearance of "newness" so painfully evident in a newly built settlement; and long before trees and shrubs have become well established, will transform the general effect into one of homely comfort and affectionate care. They have done more to cover and conceal the unsightly evidences of man's stupidity, coarseness or neglect, and to beautify inharmonious natural environments, than any other class of things that grow.

Farming in Farfarshire, Scotland

By David M. Fyffe

It should be understood that the land in Scotland is nearly all owned by landlords or, what is termed, landed proprietors. These properties are divided into farms, which range in size from 80 to 600 acres. The land is mostly all arable, sometimes there is a piece of woods, or rough ground, not fit for cultivation, left for pasture.

In my neighborhood farms run from 250 to 350 acres. They are generally styled by the number of pairs of horses required to work them. The number of horses required is governed by the distance of the farm from the railroad station, and the kind of land. Eighty acres of upland or fifty acres of clay land requires one pair of horses, when the distance to the railroad station is three or four miles.

The land is not divided into sections, the same as it is in this country. Each farm has a name, and if advertised for rent, the advertisement always states the name of farm, how many arable acres, and how much rough land or pasture. Some party in connection with the farm is always there to show the boundaries and to give conditions of letting. Written offers must be made by a certain time. The landlord does not bind himself to accept the highest or any offer. Part possession is given to the new tenants in September, when the harvest begins, and full possession is given on November 22nd.

The farm buildings are very commodious, and are put in good repair by the landlord. They are built of stone, and are arranged to form three or four sides of a square. They consist of a large barn to hold straw, a cart shed, above which is the granary, root and implement houses, and a horse stable. The last named contains room for all work horses and loose boxes for colts, etc.

There is stalled off stables for milk cows and fattening cattle. The center of the square is covered, and divided into pens of various sizes for young cattle. Since I left, however, the tieing up of fattening cattle has been done away with, and they are now fed in these covered yards.

Each farm has its own thrashing machine, but in the end of the straw barn. There is steam, gasoline or water power for running it. Directly back of the thrashing room is a room filled with the various machines for grinding, etc. Above this is the sheaf loft, used for holding the bundled grain, ready to be thrashed.

All thrashing machines in Scotland include a fanner which grades the grain into three qualities. The best grain is sent out of two spouts, the next grade out of a third, and the poorest from a fourth. The straw and chaff are also separated, the straw being sent from the end of the machine, and the chaff falling below the machine.

All the grain, when brought from the fields, is stacked close to the straw barn. In the winter the larger farms thrash twice a week, and the smaller ones once. The oats straw is used for fodder for horses, cattle and sheep. The barley and wheat straw is used for bedding purposes. Horses are fed hay during heavy spring work only.

A word must be said about the dwelling houses on these farms. The tenant lives in a large house near by, while the farm servants live in cottages close to

the building. Each married man has besides his wages, free house, garden plot, a monthly allowance of oatmeal, a daily allowance of sweet milk, and a certain amount of potatoes. The single men do their own cooking, and they are provided with a furnished room and an allowance of oatmeal, milk, potatoes and fuel.

Leases are usually for 14 or 19 years. The lease stipulates what improvements the landlord is to make, and the repairs for buildings, fences and drains; it also states the way the land shall be cropped. In fact, everything which shall be required from either landlord or tenant is stated in the lease. A great deal of bargaining is necessary from both parties before all is satisfactory, enough to sign the lease.

The style of rotation is generally governed by the quality of the land, strong lands being cropped heavier than light lands. Rotations are five, six or seven years; that is, the five year means three crops and two years pasture; the six year means three crops and three years pasture, and the seven years means five crops and two years pasture.

The sod is plowed in the winter and sown to oats in the spring. Artificial manure is sown at the same time. As soon as possible after harvest the stubble is plowed. In the spring it is either again plowed or else strongly cultivated. The field is now drilled with a double mould board plow, which makes deep ridges. Farm yard manure and fertilizer manure are spread in these and the potatoes dropped on top. The plow splits the ridges and covers the potatoes.

Turnip ground is treated in the same manner, only the ridges are split before the turnips are sown. A one-horse machine is used, which sows two rows at a time.

Usually 10 to 20 loads of farm manure and 200 to 350 pounds of fertilizer are used on one acre. Certain brands of the latter are used for potatoes, while others are used for turnips, according to the land.

After the removal of these crops the land is again manured, with well rotted manure or crushed bone, the former being put on before plowing, while the latter is put on at the time of seeding. Lime is often used with this crop, which is generally barley or wheat. Grass seed is sown at the same time. This land now lies two years in pasture.

The same rotation is used for the six year, only it lies three years in pasture. The seven years' rotation is about the same being oats; potatoes or turnips; wheat or barley; potatoes or turnips; wheat or barley, with grass seed. Then it lies two years in pasture. In this rotation potatoes are never planted twice in the same ground.

When a tenant is at the end of his lease he can sell off the half of his growing crop, and the incoming tenant has to take the other half at a valuation which is arrived at by three practical men. On some properties the whole growing crop is taken over by the incoming tenant. This latter way is a good thing for the farm.

An outgoing tenant is allowed a compensation for all inexhausted manure; that is, for certain kinds of manure applied during the last three years of his lease. This applies mostly to artificial manures, such as the different kinds of crushed, ground or dissolved bones, oil cake or other grains, which may have been bought for feeding purposes. The largest compensation is given for lime, none being allowed for nitrates, which are considered rush crops and do not leave the land in very good con-

(Continued on page fourten)

Calcium Carbonate in the Soil

By M. A. Bachtell, '11

No matter how rich a soil may be in one or two elemnts of plant foods, the proportions in which the other necessary elements are present must be taken into consideration if we are to secure maximum crop yields from our fields. Of the elements of lesser importance as food to plants calcium has first claim. Calcium carbonate has been used for soil improvement since the beginning of agricultural history. The farmers of England and France applied it in the form of chalk or marl, but the early Romans, as well as the Chinese and Japanese, used common lime. They were guided by no definite theories of soil fertility, but by the fact that beneficial results usually followed. Today, the effects of liming soils are fairly well understood from a chemical and physical standpoint, but comparatively little has been done toward determining the exact physiological explanation of some of the results in the ensuing plant growth.

Although the effects of lime in the soil are numerous and complete, there are two principal effects, one of which due to the basic property of lime results in a building up process; the other, due to its causticity, in a destructive one. The various results may be grouped as those brought about by its action on

(1) The mechanical condition of the soil,

(2) The chemical composition of the soil,

(3) The biological characters of the soil.

The mechanical condition of clay soils is most frequently benefited by liming. The fine particles of such soils are apt to fit so closely together that air and water have not easy circulation among them. Lime tends to flocculate the particles into granules, thus allowing better aeration and a more ready transit of gravitational and capillary water. Lime also has a mild preventive action against the troublesome crusts which tend to form at the surface after each rain.

Phosphorus and potassium are present in the soil largely as insoluble compounds. Lime and Ca CO_3 have an important bearing on the chemical composition of these compounds. They act upon the silicates of potash, forming an insoluble silicate of calcium and a soluble carbonate of potash. In some similar way it also liberates phosphoric acid from some of its insoluble compounds. In his way plant food is made available. When phosphoric acid is added to the soil in the form of superphosphates, it quickly reverts to some insoluble form. It naturally changes to $Ca_3(PO_4)_2$, but if calcium is present in insufficient amount some will combine with iron and aluminium to form their respective phosphates. These are not as readily broken down as is $Ca_3(PO_4)_2$, and moreover they are sometimes really injurious to the plant.

The building up process in soils is brought about by the increased growth of legumes and nitrogen-gathering bacteria. These bacteria, as is well known, live in little tubercles on the roots of plants and convert atmospheric nitrogen to nitric acid. Their activity is hindered by acid conditions. Acid conditions may arise from an excess of their own product or from the organic matter, consequently some base should

be present in the soil in sufficient quantity to unite with these acids as soon as they are formed, thus converting them into harmless neutral salts.

The destructive process results in the depletion of the organic matter of the soil. Quicklime (Ca O) and hydrated lime ($Ca(OH)_2$) are known as caustic lime and have the power of destroying the substance of organic matter by chemical action. Organic matter plays an exceedingly important part in the physical condition of soils, so that if we use lime to hasten its decomposition it must be only on those soils exceedingly rich in this constituent or on those in which the supply is kept up by the addition of farm manures or by green manuring. Although the immediate effect, when used on soils naturally deficient in humus, may be increased crops the soil's condition is being made worse because it is being rapidly depleted of its former meager source of nitrogen without the addition of any more. To correct acid conditions, and to better the physical condition of the soil, then should be the most rational use of lime and the chief reasons for applying it to the soil.

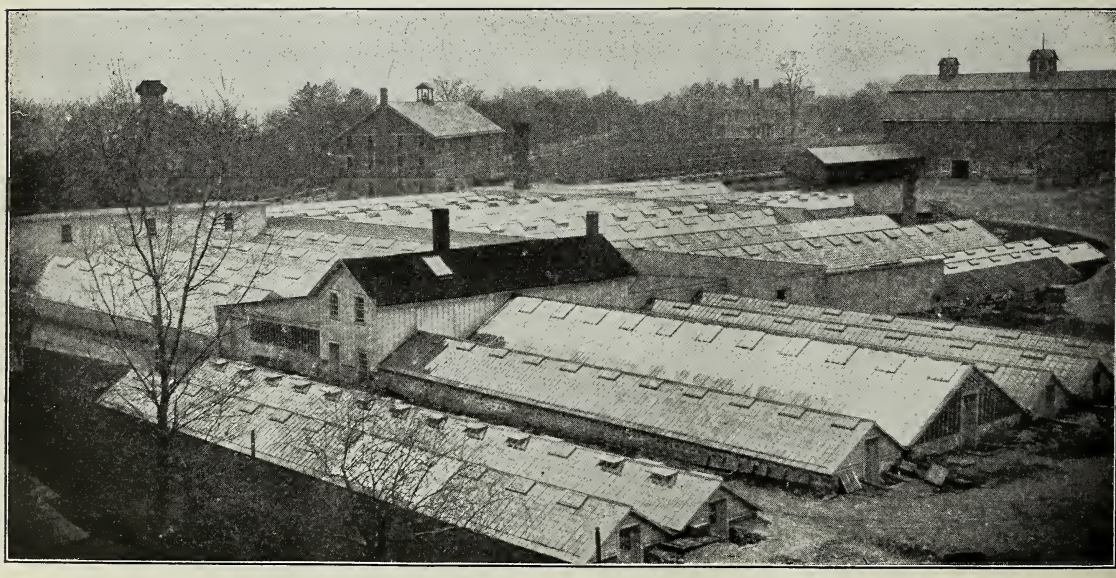
The proportion of magnesium to calcium has an important bearing on plant growth. An excess of magnesium is positively injurious. Experimenters have determined that this proportion should never be greater than 4:7. The necessary function of magnesium in the plant is to carry phosphoric acid. Magnesium is more movable in plants than calcium and a molecule of this element may serve repeatedly as a carrier of phosphoric acid. Hence it will be seen that a soil may be low in magnesia content and still good crops will be produced. On the other hand, if the amount of magnesium in the soil is greater than that of calcium, the calcium-nucleo-proteids of the organic structures are transformed to magnesium salts, while the calcium of the former enters into combination with the acid of the magnesium salt. This change seems to hinder the absorption of food compounds. Also when calcium salts are present in the soil in insufficient amounts irregularities in starch transportation have been observed. The starch collects in the pith and bark of the lower part of the stem. The cause of this cessation of starch transportation may be that the cells fail to produce the diastase which is necessary to dissolve the starch or it may be that the plastids which produce starch from sugar are unable to form in the growing parts. In the latter case the accumulation of sugar above prevents the further solution of starch below.

It is often a difficult question to tell whether a soil would be benefited by liming. There are probably very few soils that would be injured by proper liming, but on the other hand unless it is going to do some good it is needless to go to the extra expense involved in its application. Chemical analysis will not be necessary to answer the question. Litmus paper gives a fairly accurate test for soil acidity. A study of the plants growing upon a certain soil will give some hint of the need of lime. Some plants, such as the clovers, are lime lovers; others, such as sorrel, are lime haters. On soils rich in lime the plants tend to be more compact, shorter-jointed, stronger in the stem and with a more luxuriant development. Fruit-bearing plants also incline more to productiveness on such soils. The experimental plot, however, gives the most conclusive answer to the soil's need of lime and all indications may be thus verified if one wishes.

The form of lime that is cheapest

and most easily obtained should be applied. In whatever form it is applied its ultimate composition will be Ca CO_3. Thoroughly air-slaked lime is exactly the same material as finely ground limestone. This fact would tend to lead us to apply the limestone because it is cheaper and less disagreeable to handle. The amount required will vary with the soil, but about two tons of ground limestone per acre applied every five years will usually be found sufficient. Lastly it should be remembered that lime is not a fertilizer, but a soil amendment, and should be used as such. In Europe recognition of this principle has given rise to the proverbial expression:

"Lime and lime without manure,
Will make both farm and farmer poor."



This illustration shows about half of Stoors & Harrison's 170,000 square feet of glass, under which is propagated and raised a vast quantity of plant life.

Farming in Farfarshire, Scotland

(Continued from page eleven)

dition. The outgoing tenant is also allowed so much per cubic yard for all farm yard manure left on the farm. The price is fixed greatly on the quality and amount of feeding stuffs fed to the animals.

The tenant is allowed time to lift one crop before he pays any rent.

Some History of Advanced Registry Testing and What Has Been Done in Ohio

By D. R. Vanatta

The testing of dairy cows for milk and butter-fat has been in practice, we might say, from time almost immemorial, although the tests conducted up until the invention of the Babcock tester by Prof. S. M. Babcock in 1890 were really or little or no value, for they had no definite nor accurate method of testing. The tests which were churned would be of wide variation, due to the fact that probably no two people would be able to get the same amount of cream in the butter, which would allow for a wide variation in the results to be obtained.

The various breeds conducted private tests previous to this date, which although inaccurate to a certain extent, were of value to the breed. The Jersey Cattle Club was the first to establish rules for the different ages of their breed, and was followed by the other important dairy breeds in the order named—Guernsey, Aryshire and Holstein-Friesian.

This work has been carried on for the past few years under supervision of the various Experiment Stations and Agricultural Colleges of the respective states, Wisconsin being the leading state in this work, due to the efforts of Prof. S. M. Babcock, Gov. Hoard and others, who realized the benefits to be derived from this work, organized testing associations which were composed of a number of dairy-farmers who hired one man to do their testing and this man would visit their farm once each month and make a two days' test with the Babcock tester. The results of these tests were given to the dairyman, which showed him which cows in his herd were the most profitable. This work was also taken up by some of the other states, New York being a close second in the number of cows tested. The work in Ohio was only begun in a small way previous to 1907 through the efforts of our previous Professor of Dairying J. W. Decker and Prof. C. S. Plumb, of the Animal Husbandry Department of the University. Since that time the work has been conducted by Prof. Oscar Erf, of the Dairy Department, who has been doing all in his power to push the work to the front and better the dairy conditions in our state. At present we have 112 Jerseys in this year's test, which are tested two days in each month during the year; 106 Holsteins, which have made the seven-day test, and four which are in the year's test; 24 Guenrseys in the year's test, and 16 Ayrshires in the year's test. Besides this work we have one testing association which is conducted similar to the Wisconsin associations. I might say this work is being carried on by students of the Dairy Courses and Winter Short Course students, who have learned to test fairly accurate, also by some of the long course students who have been specializing along dairying. And I would like to say that to the student who expects to specialize along dairy lines, the writer finds it is well worth while to do some of this work, for it brings you in contact with the dairyman who is able to give you some good information along the practical side of dairying, and at the same time he will usually be able to ask you some practical scientific questions which con-

front him in his work, which will tend to fix them in your mind as points which it is worth while to know, and at the same time you are receiving wages which is worthy of consideration for the time spent at this work. It also tends to fix the type of cow in one's mind which is the large producer and correlate the form with function.

The following are some of the records produced by cows tested by the department and the owners of the cows:

Jetty's Peach, J. H. B., No. 173,348, who produced 11,282 lbs. of milk, 550 lbs. of butter-fat, and will make the double A class in this breed, which makes this cow the highest producer of the Jerseys as yet tested by the department within this state. This cow is owned by Dr. S. B. Hartman, of Columbus, Ohio, who has thirty in the yearly test.

Doede Bienna Flora, H. B., who produced 511 lbs. of milk, 21.36 lbs. of butter-fat, in seven days, which in itself speaks well for this cow, and is the highest Holstein test so far made by this department. She is owned by F. A. Branch, of Medina, Ohio.

Honor Bright, No. 17524, who produced 12,674 lbs. of milk, 694.69 lbs. of butter-fat in one year, which is the highest record produced for any Guernsey tested in the state. She is owned by Myron C. Bright, of Youngstown, O.

The following is a list of some of the more prominent persons who are doing testing in their herds:

L. E. Holden, of the Good Hole farm, Mentor, Ohio.

S. B. Hartman, Columbus, Ohio.

F. A. Branch, Medina, Ohio.

J. White, Greenfield, Ohio.

Sears & Nichols Co., Chillicothe, O.

H. E. Stokes, Waynesville, Ohio.

G. A. Dinol, East Claridon, Ohio

L. C. Connell, Fayette, Ohio.

F. N. Burr, Wauseon, Ohio.

The above list of names tends to show that our most important dairymen and breders realize that this work is worth while to them, and what the student should do is to help extend the work in his home community. It has been suggested by one of our Professors that the students should go further and collect a purse for the dairyman who has the best testing cow for the next year. This would show the dairymen of our state that the students are interested in this work and they would take more interest in it and thus realize the best results from their opportunities, which are open to any breeder of registered dairy cattle of today.

Humus

By W. J. Hendrix

The most difficult thing about a discussion of humus is to give a definition of the term. Humus in a popular sense is almost anything that will give a dark color to the soil and make it light and open. This is about as good a definition as can be given if the above is qualified by adding that it is partly decayed organic matter. The term is so comprehensivce. that from the time organic matter is received by the soil and when decay first sets in till the organic matter is entirely decomposed, it would not be improper to call the substance humus. We cannot see any vaild objection to calling well rotted manure, that is hauled from some barnyards, humus. Here the decay has taken place and the bulk of material often reduced to one-half, so it fits the definition in that it is partly decayed organic matter. Perhaps one of the advantages of fresh manure over partly decayed manure may be explained on this basis. Every one admits that humus and its decay is beneficial to the physical condition of the soil, but where manures have been allowed to decay at least one-half before being added to the soil the effect of this decay is lost, not to count the undesirable change that has taken place in the manure or the loss of elements by leaching.

The bacteriological definition differs very little from the popular one. That is humus is defined simply as "decaying organic matters in the soil," by Lipman, America's greatest soil bacteriologist. No doubt as more is known about soil bacteriology, the term will be restricted in its meaning.

In chemistry humus is defined as salts of the humic acid group. The humic acids are humic, ulmic, cerenic and apocerenic. In nature ulmic acid and ulmin occur in brown humus, while black humus contains humic acid and humin. Humic acid may be prepared artificially by boiling sugar, starch or gum with an alkali or a strong acid. The composition of humic acid prepared in the above manner is given by Storer to be $C_{40}H_{24}O_{12}+3H_2O$. Storer gives the composition of ulmic acid $C_{40}H_{28}O_{12}+H_2O$, but he does not attempt to give the structural formula for either of these acids. It will be noticed that neither of these acids contain nitrogen. This is not true in nature, however, as humus always contains nitrogen, although in varying amounts. Cerenic and apocernic acids are the products of the decomposition of humus. In decaying organic matter these acids occur in the following order: Ulmic, humic, cerenic and apocernic, the ulmic being first to appear in the brown humus or peat, later as decay continues and the substance turns darker humin replaces the ulmin. It will be noticed that Storer gives ulmic acid a larger per cent. of carbon than humic. This is reasonable because as the decay continues CO_2 is given off, thereby reducing the per cent. of carbon. Cerenic and apocerenic acid salts only occur in moist, loose open soils where oxidation is easy and are the last products of decaying organic matter.

These acids act strongly upon the more decomposable silicates of the soil and may in the course of time dissolve out most of the plant food ingredients. Further investigation may show that some of the action now credited to humic acids may be given to carbonic acid.

It is hard to distinguish the action of these acids apart in the soil, due to the fact that they are so closely associated and there is always such a large per cent. of CO_2 present in the soil.

Normal humus stands very close to peat and if humus were compressed it would be hard to tell it from peat. Yet peat if removed from its bed requires a great amount of oxidation and neutralization with lime before it answers the purpose of humus. It might be proper to say that peat is humus soaked with antiseptics or acidefied.

The organic matter is decomposed by bacteria and fungi. These agents act only under certain moisture and temperature conditions. When moisture is absent oxidation is very rapid on open loose soils and all traces except the ash of organic matter disappears. This is what occurs in arid regions. Where there is an excess of moisture decay only goes on for a short time, the material turns brown due to the formation of ulmic acid and the material gives an acid reaction. This is the condition in logs. Only a few kind of bacteria can work and these must derive their oxygen from the compounds in the materials because the water-logged condition excluding all free oxygen, hence we have Marsh gas CH_4, phosphorus and similar substances given off at the surface of the log. A few moulds act, but for all practical purposes the whole mass is sterile, the bacteria having been killed off by the formation of free acids. This is demonstrated by the fact that even after old swamps are thoroughly drained they have to be limed and stirred before they produce crops. In the logs the materials are kept in almost perfect preservation for many years. The old vegetation that has gone down in the Buckeye Lake has turned brown, but retains its form and probably will retain its form as long as undisturbed, even though it be centuries. There is no doubt a slow change taking place in this vegetation, but we do not know just what it is. If we did, perhaps we would be one step nearer the explanation of the formation of coal.

Humus is formed best in well aired, moist soils. Here no injurious effects from the free acids are felt, but the organic matter is changed into a substance where the nitrogen is more available than formerly and the humus holds moisture due to its affinity for water. When wet it is plastic; in this way it acts in the same way as dough, holding the gases of the soil and making the soil light and of a desirable physical nature. When the bases break their prison walls the gelatinous form retains its shape, making passage ways for circulation of air. The gelatinous humus also catches and holds the dissolved solids in the soil.

Cultivation greatly aids humification in opening the soil to the air, it destributes the humifying organisms and distributes the organic matter in order that these organisms may act upon it more readily. In loose, sandy soil humus disappears very rapidly, due to the vigorous action of the organisms, stimulated by the free supply of oxygen and the ready removal of gases excreted by the organisms, while on the other hand in heavy clay soils organic matter decays slowly, assuming a peaty form. In this soil the organisms cannot get free oxygen, the gases excreted by the organisms cannot escape and the soils give an acid reaction.

The color of a great many soils is due to humus. Throughout the Miami Valley, what is known as black land is looked on by the farmers as being the best land. The color of this land is due to

the large amount of humus in the soils. Most soils will get darked in color as manures are added. We have seen soils that were white changed to a chocolate brown in ten years by thorough tillage, rotations of crops and additions of manures.

The amounts of humus in the soil was first estimated by burning off the volitile matter. This gives too high results because many soils contain organic substances which from a chemical point of view are not humus. Then again there are other losses that must be considered. The only accurate method now in use is the Grandeau method. The one used in the laboratory—namely, by treating the soil with an acid, then ammonia and filtering. By adding acid to this solution the humic acid is precipitated.

In arid soils the humus content often falls below .3+. This small amount of humus manifests itself in the light gray color of the soil. In humid regions the humus rarely exceeds in cultivated fields .5+ and often falls below .3+. Meadows and woodlands contain the highest per cent. of humus. In peat marshes, however, it runs up as high as .20+ or above.

The insoluble humates of lime, magnesium, iron, manganese, and aluminum are present in most soils.

The ash from a humus from Minnesota prairie soils shows the following analysis:

Insoluble matter	61.97+
K_2O	7.50
Na_2O	8.13
CaO	0.09
MgO	0.36
Fe_2O	3.12
Al_2O_3	3.45
P_2O_5	12.37
SO_3	.98
CO_2	1.65

Humus varies greatly in the per cent. of nitrogen from 1.71+ in humid regions to 22+ in arid regions.

Investigations in Kansas have shown that the larger the number of bacteria per cubic centimer the richer the soil. On the request of Prof. Hilgard these soils were analyzed for humus and it was also found that the richest soils contained the largest amount of humus. It was found that a productive soil, a large number of bacteria per cubic centimeter and a large per cent of humus went hand in hand, each factor varying directly with the other. This is, however, as one would expect, as humus is the food for the bacteria and they would be most plentiful where food was most plentiful. Whether the increased fertility of the soil was due to the large number of bacteria present or the large amount of humus present is rather hard to tell—probably due to both. European investigators have sterilized soil with carbon bisulphide and other antiseptics. They obtained a falling off in the crop production for the first couple seasons, but when the soil regained a part of its bacterial flora there was an enormous increase in crops, but when sufficient time had passed for the replacement of the entire flora crop production went back to normal.

The Kansas investigators found soil to contain as high as 33,000,000 bacteria per c. c. This is much higher than the results obtained by European investigators, their figures running from one-half million to 30 millions per gram. Most counts range from one to five millions bacteria. My own counts have been made in winter, when the count is always much lower and have counted from one to five millions bacteria per gram dry soil. My counts have shown on the average that soils containing the largest amounts of humus contain the

larger number of bacteria. For example, soil taken from the horticultural gardens gave a count of one to one and a half millions per gram of dry soil, while building sand used in the Student building gave a count of 4,850 bacteria per gram of dry sand. It must be remembered that it takes a larger bulk of garden soil, however, to make a gram than it takes of buuilding sand.

I made a count on fresh cow manure, getting over 334 millions bacteria per gram of dry matter. Taking the average size of bacteria, a c. c. will hold about 600 millions bacteria. Of course a c.c. of dry manure will not weigh one gram. Authorities say that almost one-half of the weight of the dry matter in faeces are bacteria. From these figures it is easily seen that humus, bacteria, moulds and fungi are closely dependent on one another.

Humus is distributed evenly in the soil by fungi and animal life. A section of soil shows the humus evenly distributed in the soils, while roots and other organic matter is distributed very unevenly. The fungus lives on the organic matter, but its mycelia threads run in all directions in the soil like spider webs. These threads serve as means of distribution for humus after it is assimulated by the fungi. Worms have a great influence on distribution of humus. Every one is familiar with Darwin's classic estimation of the material that is transported to the surface by angle worms. Insects of all kinds that live underground aid in distribution of organic matter.

Summing up the beneficial effects of humus in the soil, they are:

1. Humus is the pathway by which organic matter is changed into plant-food.
2. Humus is food for beneficial bacteria in the soil.
3. It improves the physical condition by making it more porous, thereby aiding ventilation of the soil.
4. It helps retain moisture, and
5. Promotes chemical action.

Co-operation

Observers have often declared that the Danish farmer is the most successful business man among the farmers of the world. This is largely due to a remarkable practical system of co-operation, which, together with the movement for social and intellectual uplifting of the peasant class, has given the Danish farmers political supremacy and consequent generous government aid to agriculture.

Another unique feature is the intensive cultivation of the soil. The Danish farms are market gardens. Every inch is cultivated. In Denmark there is no cry, "Back to the Farm." Farm life is considered attractive, not only a patriotic duty but a pleasure as well.

Co-operation is by no means limited to the dairy indutsry. The Danish farmers co-operate in every possible way. There are co-operative industries and institutions covering every branch of farming and farm life. But as applied to dairying, co-operation is seen at its best.

There are more than a thousand co-operative creameries in Denmark with an overwhelming majority of the farmers as patrons, and through their co-operative export societies the farmers themselves attend to the business end of dairying.

The incomparable "Paul Neyron," a most beautiful hardy rose blooming unceasingly from June to November.

THE AGRICULTURAL STUDENT

A MONTHLY MAGAZINE DEVOTED TO THE INTERESTS OF FARMING, STOCK-RAISING DAIRYING AND CREAMERY WORK

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EDITORIAL

Great things have been transpiring during the past year concerning the scarcity of the products of consumption. This exigency has led the people to reflect upon certain causes of the present situation. Of the three great natural resources upon which our future is somewhat dependent are forests, mines, and land. It is plainly seen that our great forests are fast becoming exhausted. At the present rate of consumption our mines are of only short duration, and with the great increasing demand there only remains one of the three which is apparently inexhaustible, namely, the land. This, the basis of progress, is capable of renewing its bounty for an indefinite period. Agriculture without a doubt has the primary place in national development. Progress ultimately depends on the proper treatment of our soil, for there lies hidden the source of energy. This country has been blessed with a good soil, then why in some places has it been abandoned because of its apparent exhaustion? Because of improper treatment and wasteful methods of operation. This is what brings down the average and has caused the supposed alarming situation and cries of distress. How can the land be made to produce more and do it indefinitely? By better tillage operations, crop improvement, various phases of stock raising, conservation and proper application of fertilizing materials, adaptation of soil and crops to each other, and diversification and rotation of crops. This is not only a theory, but has been worked out in practice by many of the older countries which have been producing for centuries, and at the present time the average yield is nearly double that of this country. Above all no more land should be cultivated than can be thoroughly tilled; this means increase in production and larger profits. It is only a matter of time when more intensive methods will be practiced; when the yield will be greatly increased and at a decrease in cost of production.

We wish to anounce to our readers that the cuts used in this issue were intended to be used in the Horticultural number, but owing to an unavoidable circumstance we received them too late for that issue. We are therefore using them to illustrate this issue, though

probably not as appropriate as they would have been for the Horticultural number. We are indebted to The Storrs & Harrison Co., seedsmen and nurserymen, for the use of the cuts, and to them we extend our thanks.

Present Situation of Oleomargarine Question

By Prof. Oscar Erf

It might be interesting to the readers of "The Student" who are interested in dairying to know that the oleomargarine people have attacked the Grout Bill, which imposes a tax of ¼ cent on legitimate, white oleomargarine and a tax of 10c on oleomargarine colored to resemble butter. An attempt is being made to do away with this law and establish one which demands a tax of 2 cents on oleomargarine which is colored yellow.

On April 20th the Agricultural Committee of the House of Representatives listened to the discussions between the oleomargarine forces and those opposed to fraud in the sale and use of butter substitutes. Representatives in behalf of pure butter were present from about twenty states. It was universally agreed that oleomargarine is a legitimate product if made from wholesome fats and it was not the desire to prohibit the manufacture or use of the same. It was, however, universally agreed that every attempt should be made to drive the fraud out of the business; that oleomargarine should be sold for what it is and not be masqueraded as butter; that there should be a clear line of demarkation between butter and oleomargarine, which might be accomplished by coloring all butter a yellow hue and allowing oleomargarine to remain in its original white state. This would enable the consumer to distinguish between the two.

White oleomargarine is made from the pure oleo and neutral oils and is the best grade of oleomargarine on the market. At the present time this sells for from 16c to 18c per pound, leaving a handsome margin of profit for the manufacturer. If this same oleomargarine is mixed with cheaper oils such as cotton seed, mustard seed and palm oils, thus reducing the cost of manufacture and making an inferior article, on account of its yellow hue it sells upon the market for but 2c less than good creamery butter, the average cost of which has been about 30c this past winter. If this is to be a poor man's product, the dairymen would like to see it sold for 12c per pound rather than to have this inferior product put upon the market and palmed off upon the poor man as butter, allowing the manufacturers to make a profit of 18 cents per pound.

We hope that every one will look at this from an unselfish standpoint and assist in strengthening the Grout Bill which has been violated so many times during the past year. According to the report of the United States Revenue Department, 87 per cent. of the oleomargarine sold this past year was colored and the ten-cent tax was paid on only 3 per cent. of it, 84 per cent. being sold in direct violation of the law, the manufacturer paying only ¼ cent per pound. This shows the representaive class of men that are engaged in this business and we hope that the law can be made strong enough to bring them to time.

NEWS NOTES

G. H. Stevenson, Secretary of the National Corn Exposition, has established his office in the city and arrangements are being made for the fourth National Corn Exposition to be held at the State Fair grounds from Jan. 30 to Feb. 11. It is not confined exclusively to corn, but embraces all kinds of grains and grasses, as well as practical demonstrations of up-to-date methods, based on the experiments of agricultural colleges and experiment stations. It is expected that about thirty state agricultural colleges and experiment stations will represent some special feature of their most advanced experimental work. In connection with the exhibit, daily meetings will be held where various economic farm questions of national importance will be discussed.

During the past winter a great deal of damage was done to the wheat crop in some sections of the state. This damage was practically confined to eight counties in the northwestern part of the state, where lack of drainage caused the formation of an ice sheet which resulted in the destruction of the wheat. In some parts 10 to 15 per cent. of the area has been plowed and planted to other crops. With the exception of this area the wheat crop is better than usual.

Prospects are bright for the carrying on of extension schools for the coming year, as sixty applications have already been received. This shows the growing demand for work of this kind and the results of the good work done by the department during the past year.

Under the auspices of the Danish-American Asociation, Professor Bernhard Boeggild, of the Royal Danish Agricultural College of Copenhagen, will visit the United States during May, June and July, delivering a series of lectures at a number of universities and agricultural colleges on Dairying and Milk Supply, at the same time studying our methods and conditions. He is perhaps the greatest living authority on Dairying in Europe. At a critical period he directed the energy of the Danish farmers from the unprofitable production of bread-stuffs toward the golden field of dairying. As a consequence the prosperity has been greatly increased and is largely based upon the dairy industry.

Arrangements have been made to run a Special Dairy Train over the Erie Railroad, May 24, 25 and 26. The train will run from Cleveland to Warren, and from there through Akron to Warren. Fifteen stops of an hour and a half each will be made at various places along the line. Instructions in feeding and judging dairy cattle, the care of mlik and breeds best adapted to milk production, will be given. The train will carry cows of the more important dairy types. Night meetings will also be held at Akron and Warren and will afford splendid opportunities to receive valuable instruction in dairy work.

The judging class in Animal Husbandry, under the direction of Prof. Marshall, took a trip to Thomas E. Johnson's stock farm, May 7. On May 14, they will visit the stock farm of Carpenter & Ross, Mansfield, Ohio.

By the passage of the Wilber Bill county commissioners are given authority to establish experiment farms in Ohio counties. On petition of 200 or more taxpayers in a county the commissioners are to submit to a referendum election the project of establishing such a farm. Officers of the Ohio Station are to assist in selecting sites and are to co-operate with local authorities in experiments. Products not required for farm stock and food for employes are to be sold and proceeds used to defray expenses.

Before a small but appreciative audience Thursday evening, May 5, Prof. Marshall, of the Animal Husbandry Department, read an interesting and instructive paper upon the Relation of Biology to Agriculture. This was the first of the Sigma Pi lectures given this spring and showed considerable preparation. The Professor dealt with his subject from the viewpoint of an agriculturist, nevertheless the subject was handled in both a scholarly and scientific manner.

The University has recently purchased a Coldwell traction lawn mower of 14 horse-power to mow the campus. The machine cuts a swath 40 inches wide and has a working speed of five miles per hour. The mower weighs one ton and is provided with a roller which assists in leveling the lawn. The machine can do the work of two men with horse mowers and, although it cost eleven hundred dollars, it is considered as a paying investment.

Arrangements are being made by the College of Agriculture to give fair exhibits in various parts of the state. The dates and places have not fully been decided upon.

University Grange No. 1620 of Franklin County initiated about thirty-five members at their last meeting on April 30. Only the first two degrees were given, the third and fourth being given at the next regular meeting. The new members are mainly students from the Sophomore class of the College of Agriculture and Domestic Science. With Prof. McCall as Master, the Grange is at present in a thriving condition.

The Agricultural Extension Department has been carrying on seventeen spraying demonstrations under the direction of Messrs. Shields, Wade, Sherman, Melchers and Benbower, in different parts of the state. The demonstrators give instructions on the methods of treatment of the various diseases and on application of five or more farmers will spray the trees.

The Department of Agronomy is conducting duplicate variety tests for the Franklin County Corn Improvement Association. It is planned to have a meeting of the association on the University farm at corn harvest and discuss the results.

Through the co-operative department of the Experimental Station ninety-one variety tests of corn have been arranged for by corn associations throughout the state. During the summer, field meetings will be held at these places.

On May 6, Professor Oscar Erf spoke before the Boardman Club of Youngstown, on the subject, "The Care of cows and Bovine Tuberculosis."

Prof. Oscar Erf was in Washington, D. C., May 11, in behalf of the prevention of the repeal of the Grout Bill.

A new Agricultural Extension Bulletin has recently been published on the "Pear Brown Rot and Scab" and "The Lime Sulphur Spray;" by Prof. Wendell Paddock, of the Horticultural Department.

W. G. Yeager, '08, and C. W. DePue, '09, of Falfurrias, Texas, were recently elected President and Secretary, respectively, of the Sanol, West Texas, Farmers' Institute.

Secretary A. P. Sandles, of the State Board of Agriculture, addressed the Country Life Association at Townshend Hall, May 11.

The regular monthly meeting of the Agricultural Society was held May 4.

Colleges on Wheels

A few years ago the Department of Agriculture of the State of New York aroused the community on the subject of the supposed abandoned farms in New York State and lack of interest shown by many farmers in following up modern methods of agriculture. A great convention was held in 1907 at Syracuse, consisting of farmers, farmers' institutes, railroads and all interested in agriculture. The railroads expressed their willingness to co-operate and offered a free train; this resulted in the first agricultural special ever run in New York in November, 1908, under the auspices of the Agricultural College.

This was something needed for the eastern states and was an immense success. Various lectures were given on Milk Production, Potatoes, Beans, Alfalfa, Poultry, Fruit Culture, and Corn Cultivation. Since this time Cornell has run several Agricultural Specials, the railroad provides the free train and the college the material. Since this time many other college have taken up the work.

Agricultural special trains have now become a regular feature in railroading as aforce co-operating with the farmer for better development. They are run on the most practical plan, some for one day, others for longer time, depending on the territory to cover.—Abstract from Harper's Weekly.

"Peace has her victories no less renowned than war."

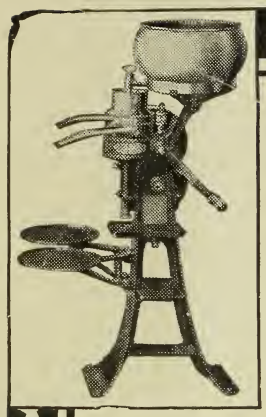
"But less profitable. Nobody ever hangs up gate money for a debate."—Louisville Courier-Journal.

Teacher to Jewish Boy—"How many seasons are there in a year?"

Levi—"Two. A dull season and a busy season."

DEAR FOLKS: I THOUGHT THE DRILL ON THE FARM WAS BAD ENOUGH, BUT THIS IS THUNDER AN' LIGHTNIN', BY GAD. IT'S MAKIN' ME LOOK OLD. AN' I NEVER KNOWED WHY UNCLE SAM CALLED HIS ARMY TH' "STANDIN' ARMY." IT'S BECAUSE YOU DON'T GIT NO RESTS.

YOUR SON



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